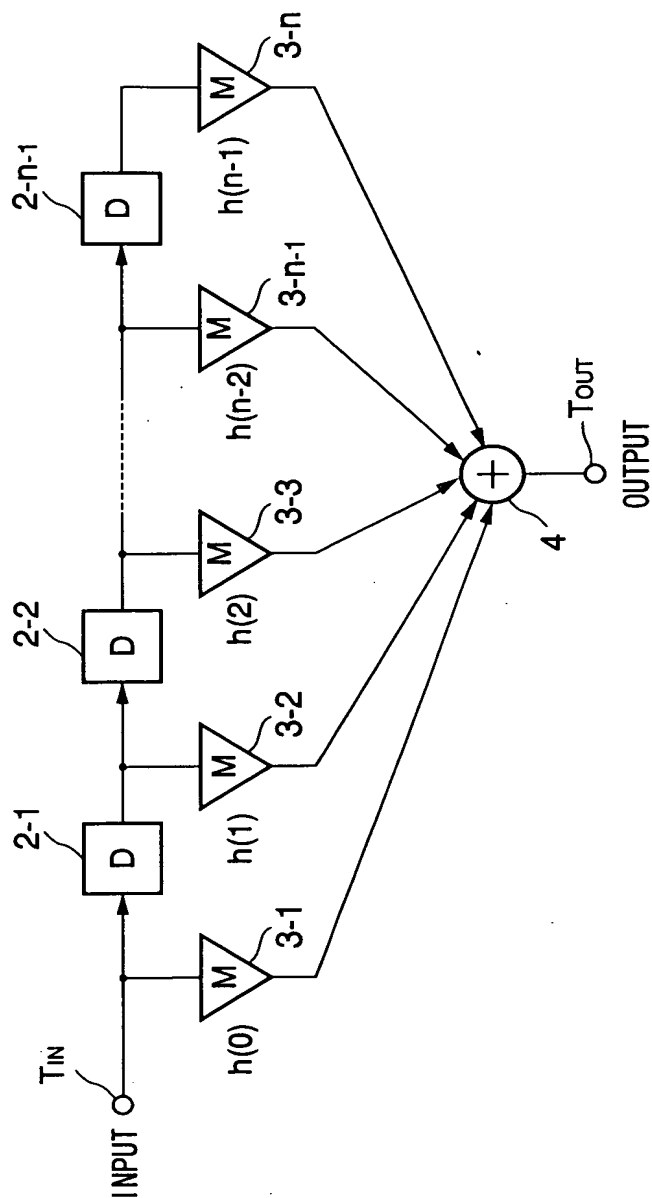


FIG. 1

1



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FIG.2A

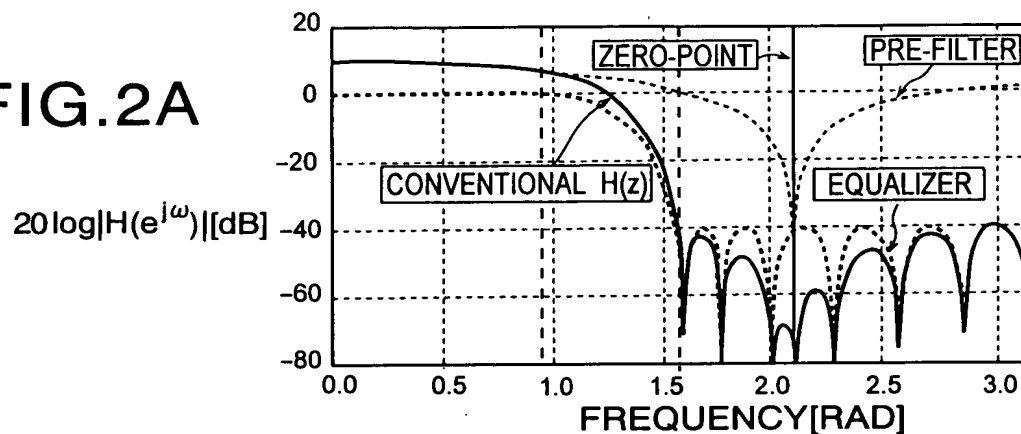


FIG.2B

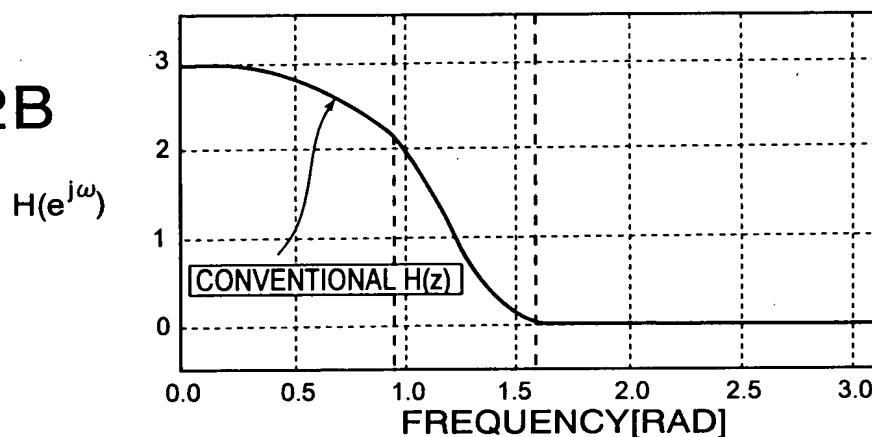


FIG.2C

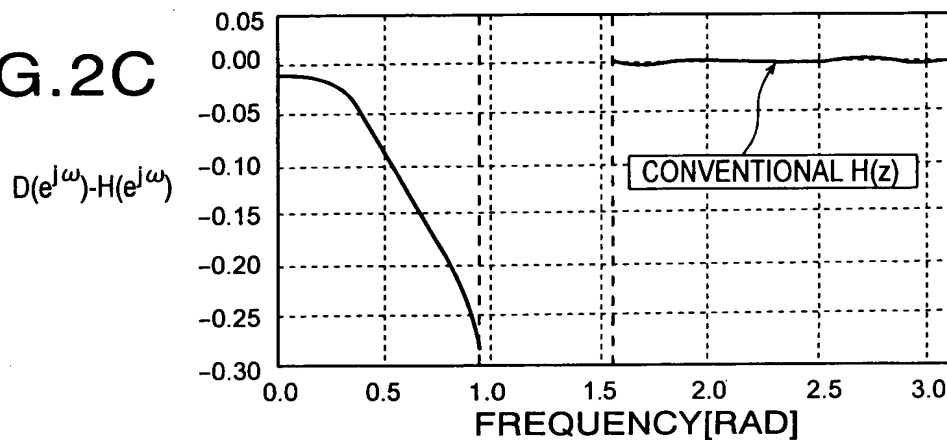
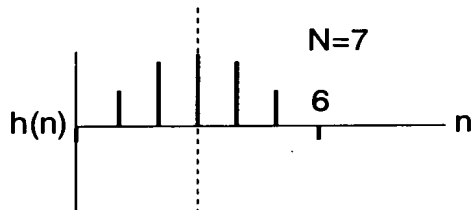


FIG.3A

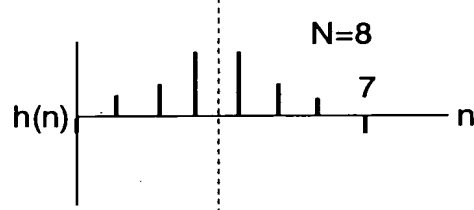
CENTER OF SYMMETRY



CASE 1: ODD NUMBER TAP,  
EVEN SYMMETRY

FIG.3B

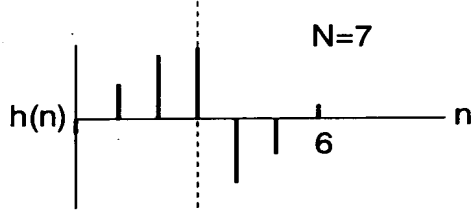
CENTER OF SYMMETRY



CASE 2: EVEN NUMBER TAP,  
EVEN SYMMETRY

FIG.3C

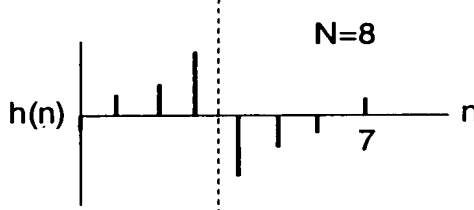
CENTER OF SYMMETRY



CASE 3: ODD NUMBER TAP,  
ODD SYMMETRY

FIG.3D

CENTER OF SYMMETRY

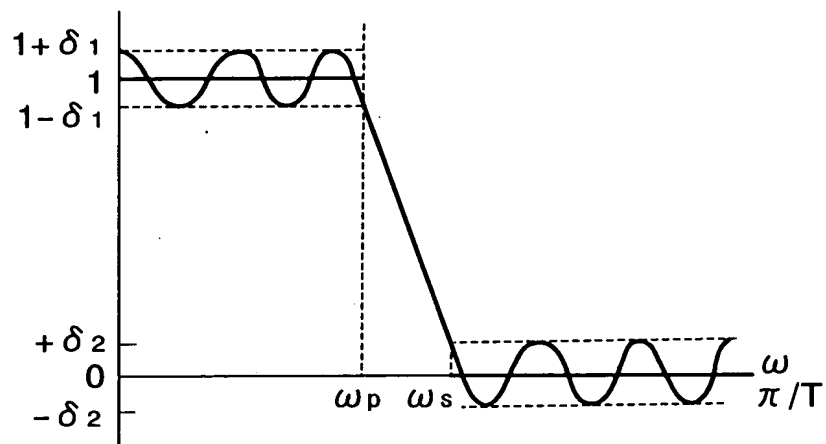


CASE 4: EVEN NUMBER TAP,  
ODD SYMMETRY

FIG.4

CASE	$Q(e^{j\omega})$	R
1	1	$(L-1)/2+1$
2	$\cos(\omega/2)$	$L/2-1+1$
3	$\sin(\omega)$	$(L-3)/2+1$
4	$\sin(\omega/2)$	$L/2-1+1$

FIG.5



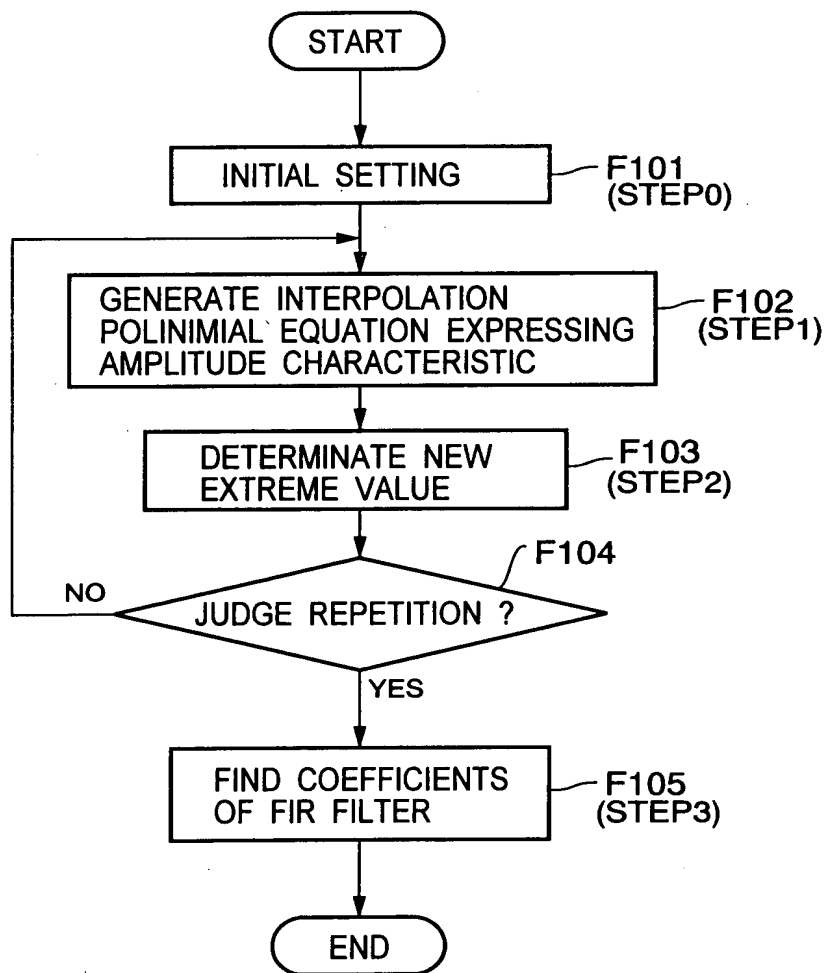


FIG.7A

FIG.7B

FIG.7C

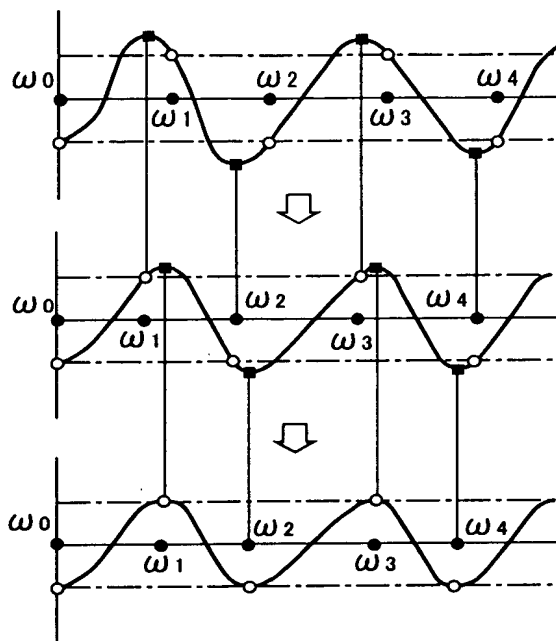


FIG.8

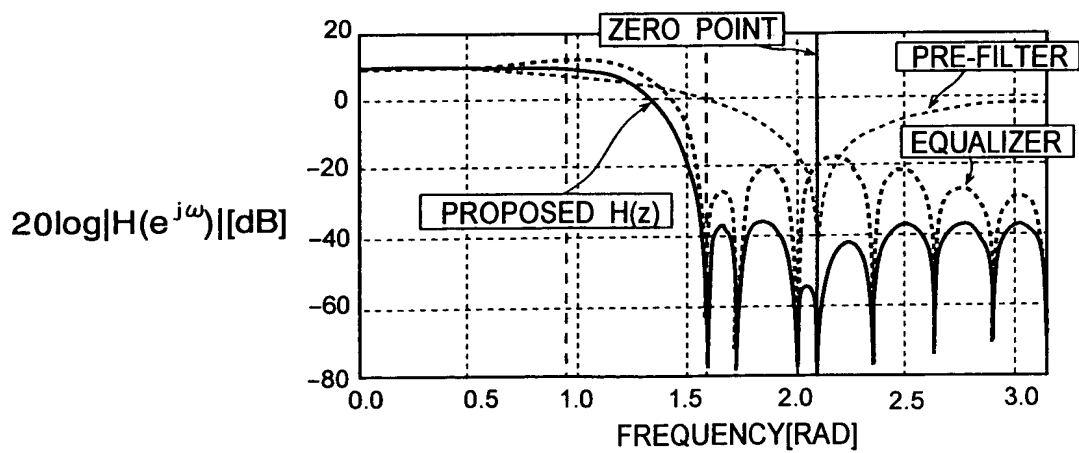


FIG. 9A

$20 \log |H(e^{j\omega})| [\text{dB}]$

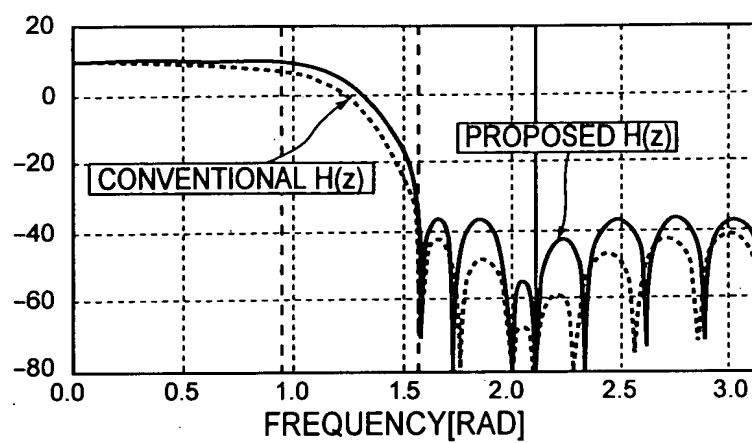


FIG. 9B

$H(e^{j\omega})$

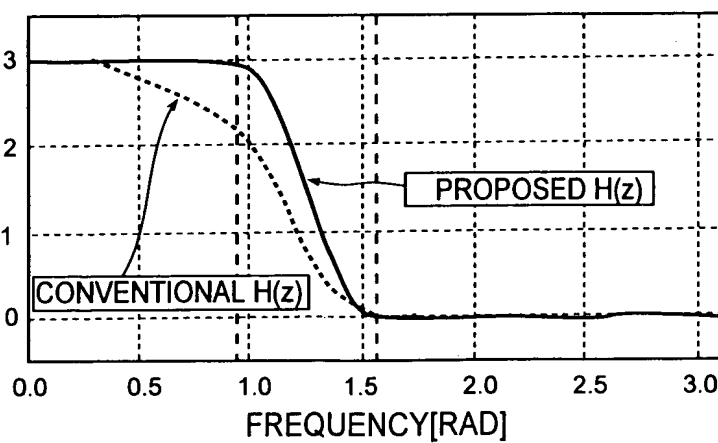


FIG.10

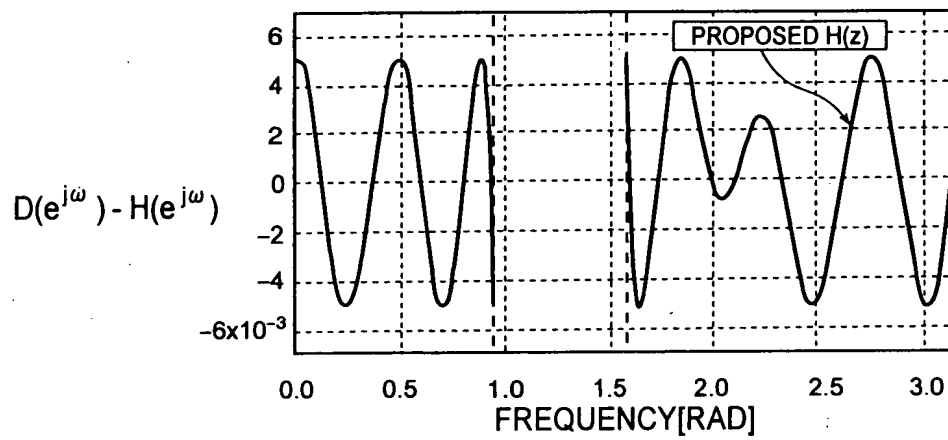




FIG.11

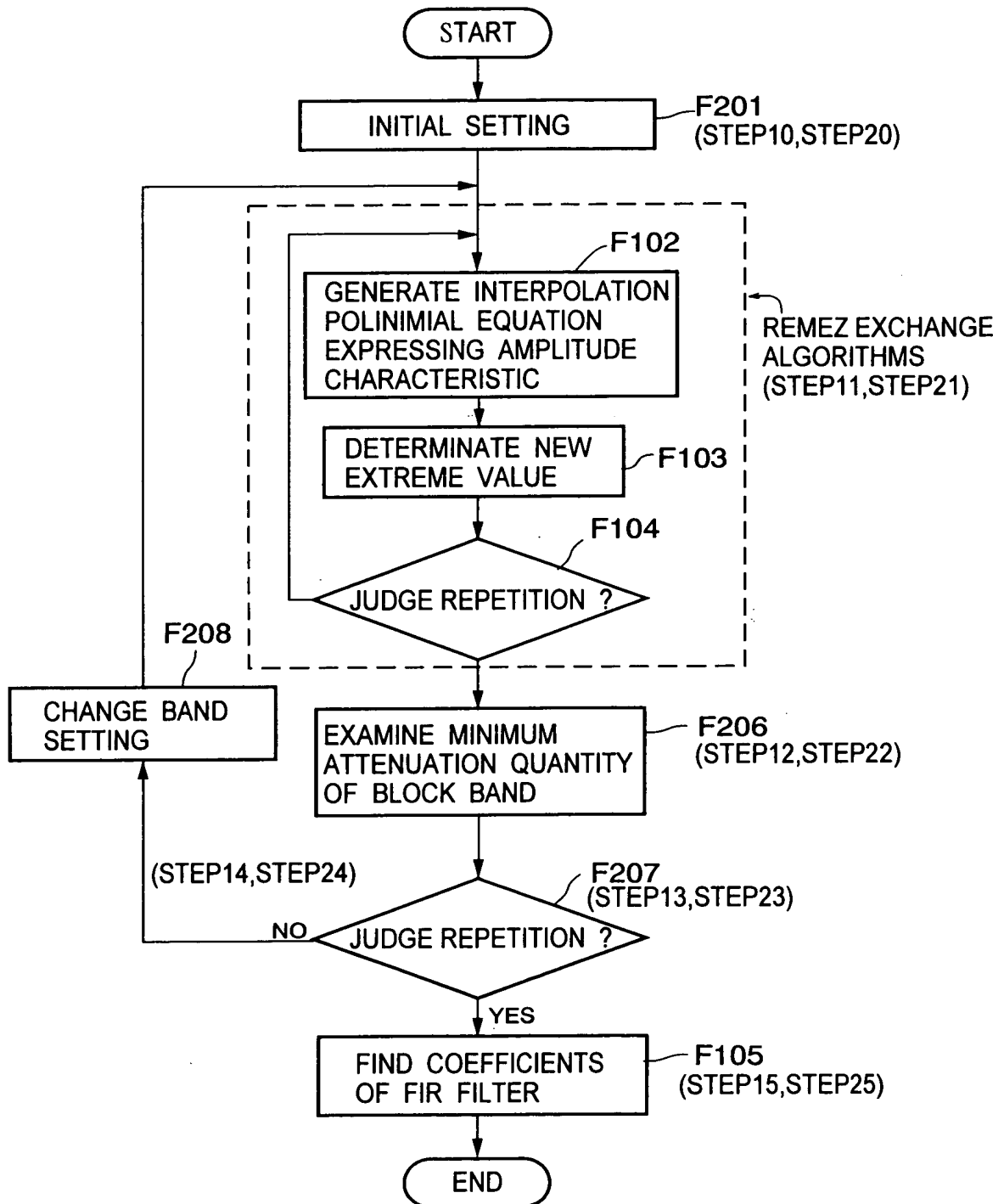


FIG.12

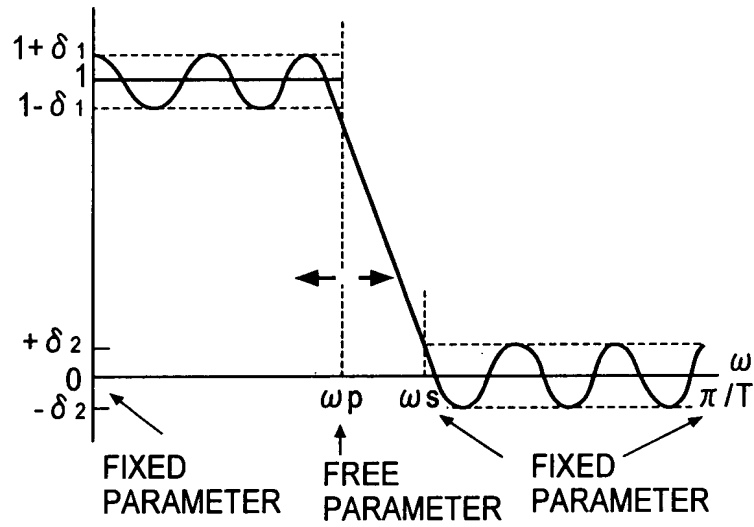
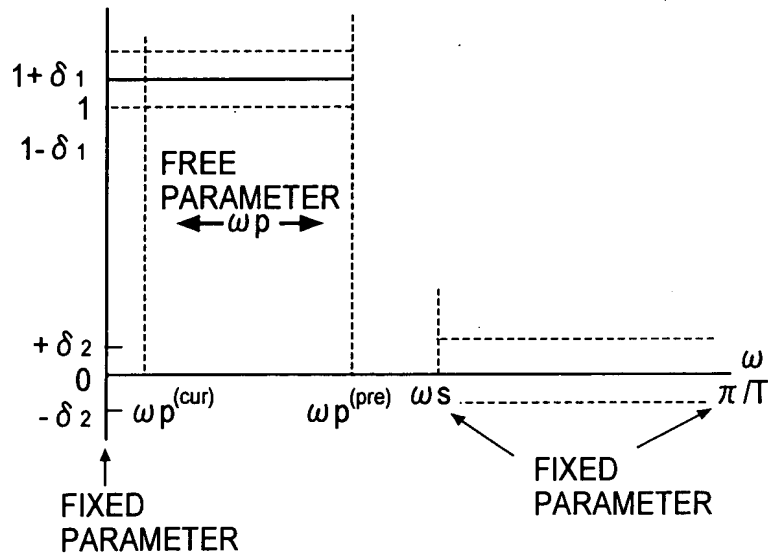
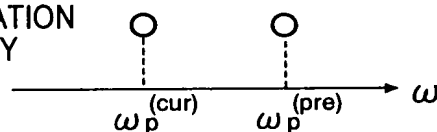


FIG.13



**FIG.14A**

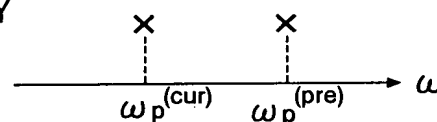
BOTH SATISFY  
→END

DESIGNATED  
ATTENUATION  
QUANTITY

FREQUENCY WITH LARGE  $\omega_p$   
IS SOLUTION IN THIS CASE  
SOLUTION IS  $\omega_p(\text{pre})$

**FIG. 14B**

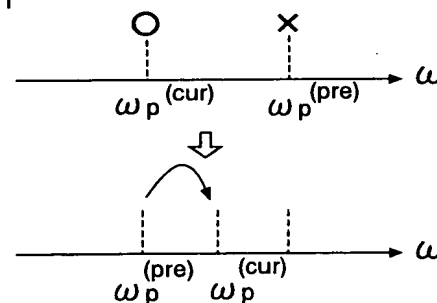
BOTH DOES NOT SATISFY  
→NO SOLUTION→END

DESIGNATED  
ATTENUATION  
QUANTITY

NO SOLUTION IN THE  
NUMBER OF TAP IN  
THAT IT DOES NOT  
SATISFY ATTENUATION  
QUANTITY

FIG. 14C

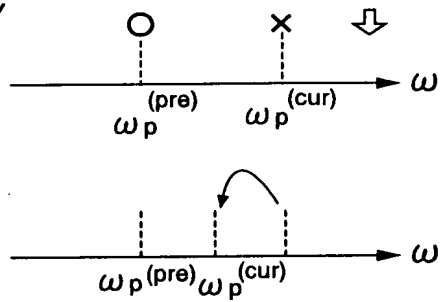
ONLY ONE SIDE  
SATISFIES  
→FOR NEXT STEP

DESIGNATED  
ATTENUATION  
QUANTITY

**FIG.15A**

ONLY ONE SIDE  
SATISFIES  
→FOR NEXT STEP

DESIGNATED  
ATTENUATION  
QUANTITY



**FIG.15B**

BOTH SATISFY  
→FOR NEXT STEP

DESIGNATED  
ATTENUATION  
QUANTITY

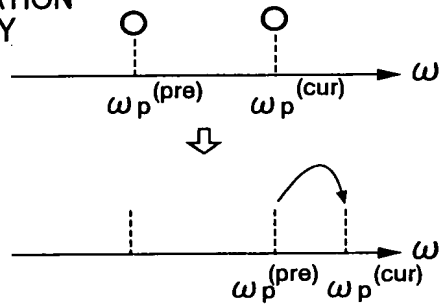


FIG.16

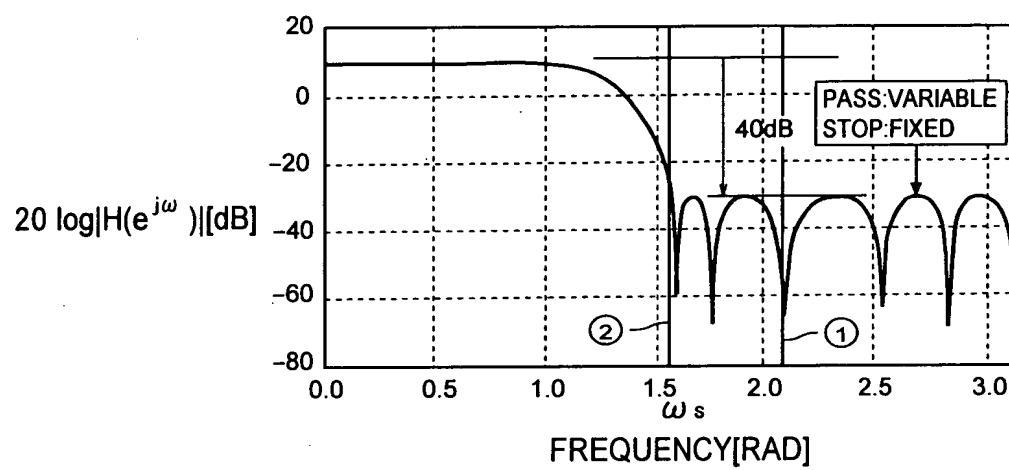


FIG.17

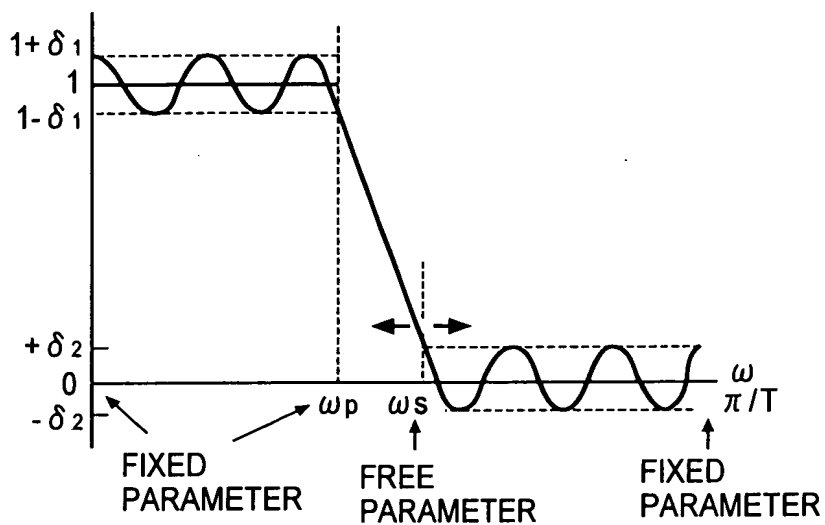


FIG.18

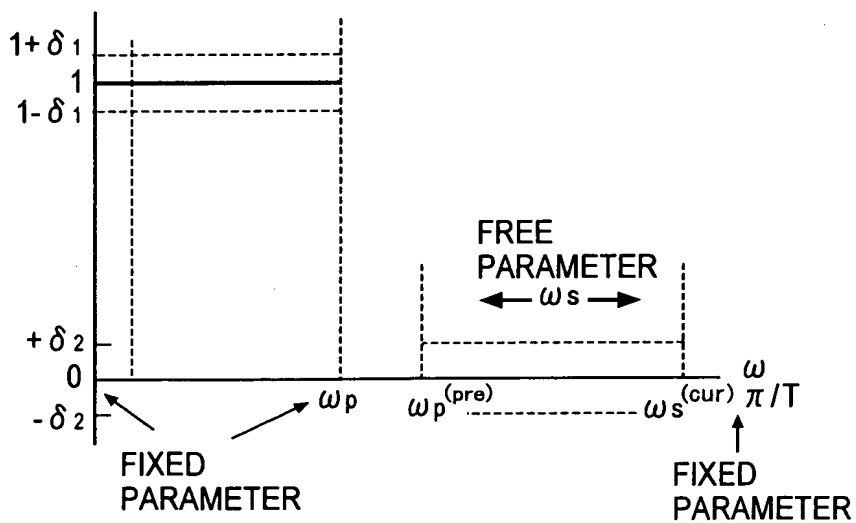
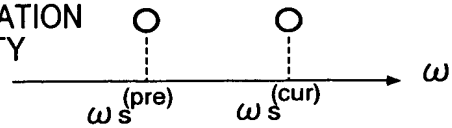


FIG.19A

BOTH SATISFY  
→END

DESIGNATED  
ATTENUATION  
QUANTITY

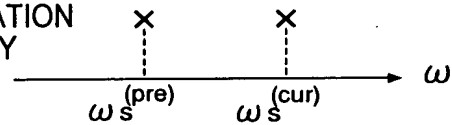


FREQUENCY WITH SMALL  $\omega_s$   
IS SOLUTION IN THIS CASE  
SOLUTION IS  $\omega_s^{(pre)}$

FIG.19B

BOTH DOES NOT SATISFY  
→NO SOLUTION→END

DESIGNATED  
ATTENUATION  
QUANTITY

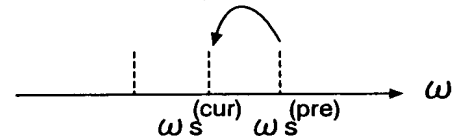
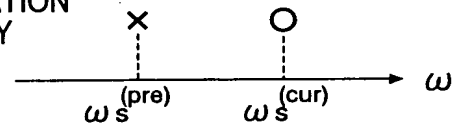


NO SOLUTION IN THE  
NUMBER OF TAP IN  
THAT IT DOES NOT  
SATISFY ATTENUATION  
QUANTITY

FIG.19C

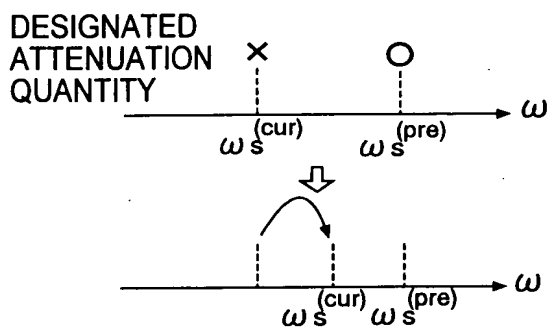
ONLY ONE SIDE  
SATISFIES  
→FOR NEXT STEP

DESIGNATED  
ATTENUATION  
QUANTITY



**FIG.20A**  
ONLY ONE SIDE  
SATISFIES  
→FOR NEXT STEP

ONLY ONE SIDE  
SATISFIES  
→FOR NEXT STEP



**FIG.20B**

BOTH SATISFY  
→FOR NEXT STEP

**BOTH SATISFY  
→FOR NEXT STEP**

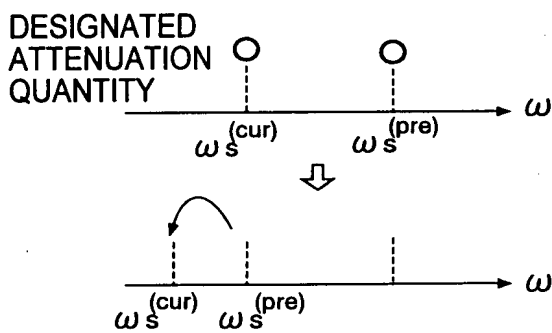
[illegible]

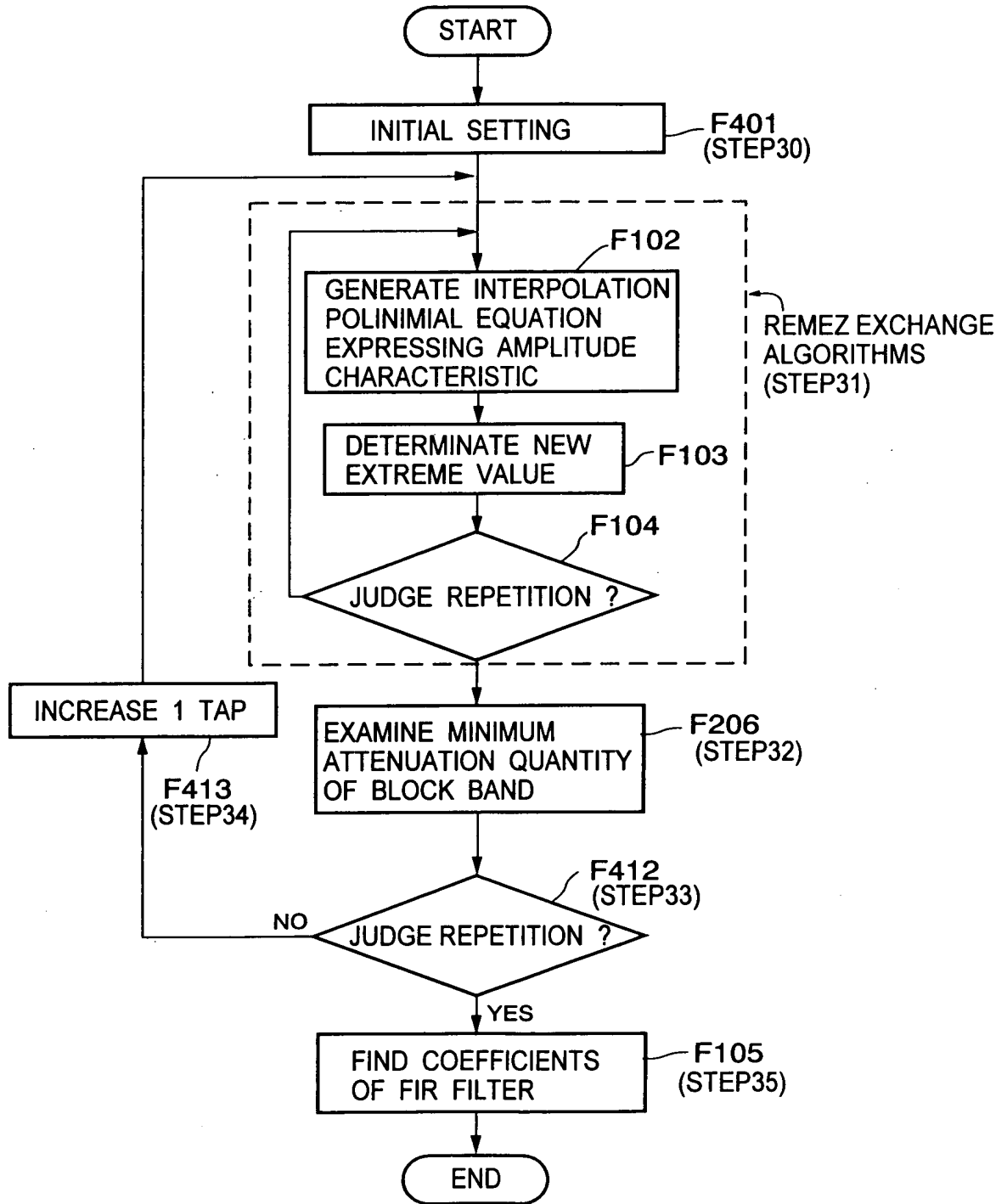




Figure 1 shows the magnitude response of a 4th-order Butterworth low-pass filter. The y-axis is labeled  $20 \log|H(e^{j\omega})| [\text{dB}]$  and ranges from -80 to 20. The x-axis is labeled FREQUENCY [RAD] and ranges from 0.0 to 3.0. The plot shows a passband with a magnitude of approximately 10 dB and a stopband with a magnitude of approximately -80 dB. The transition band is marked with a 40 dB roll-off. The plot is labeled "PASS: FIXED STOP: VARIABLE".

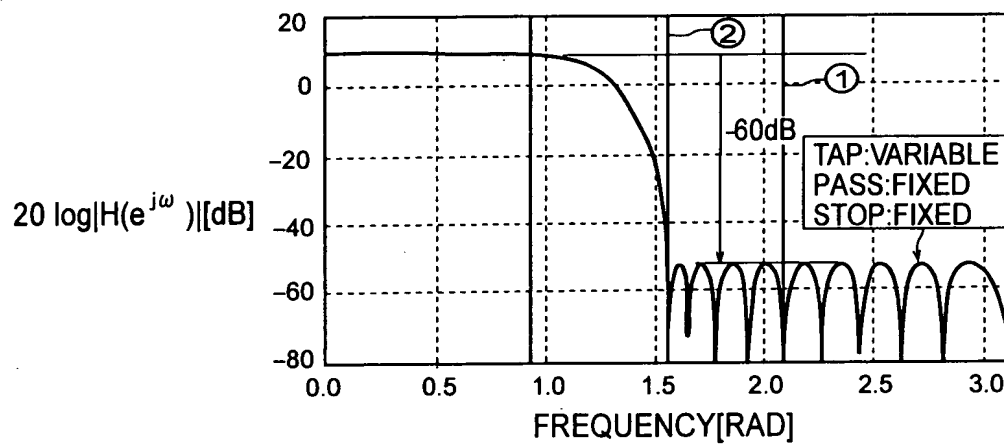
$$20 \log |H(e^{j\omega})| [\text{dB}]$$

FIG.22



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FIG.23



# FIG.24

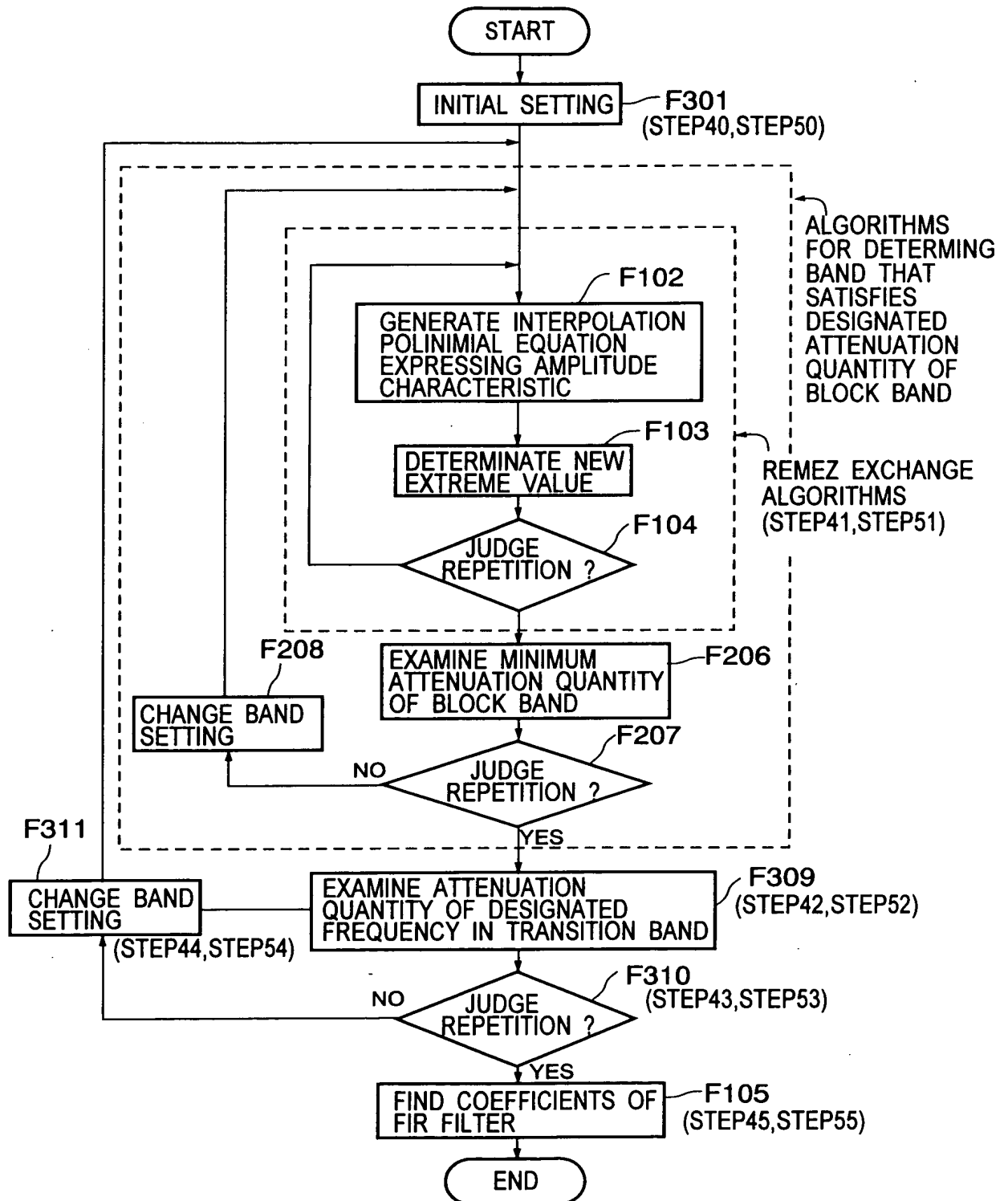


FIG.25

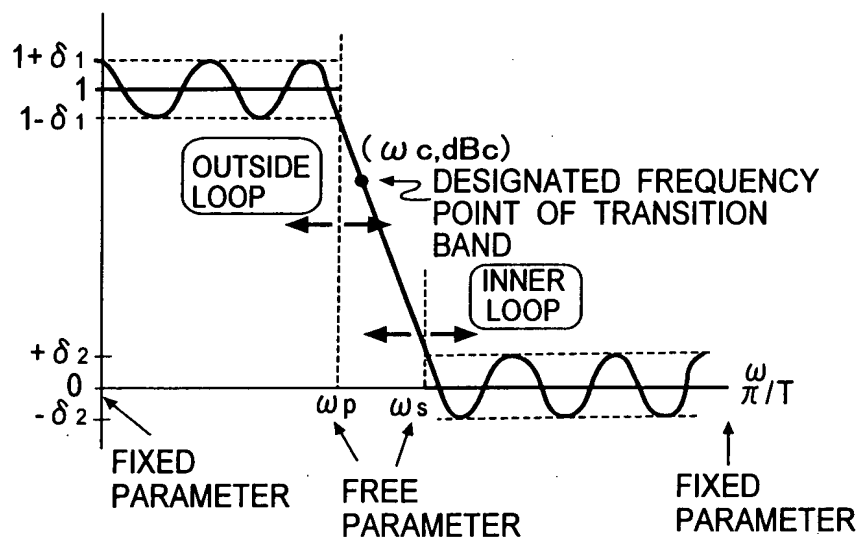
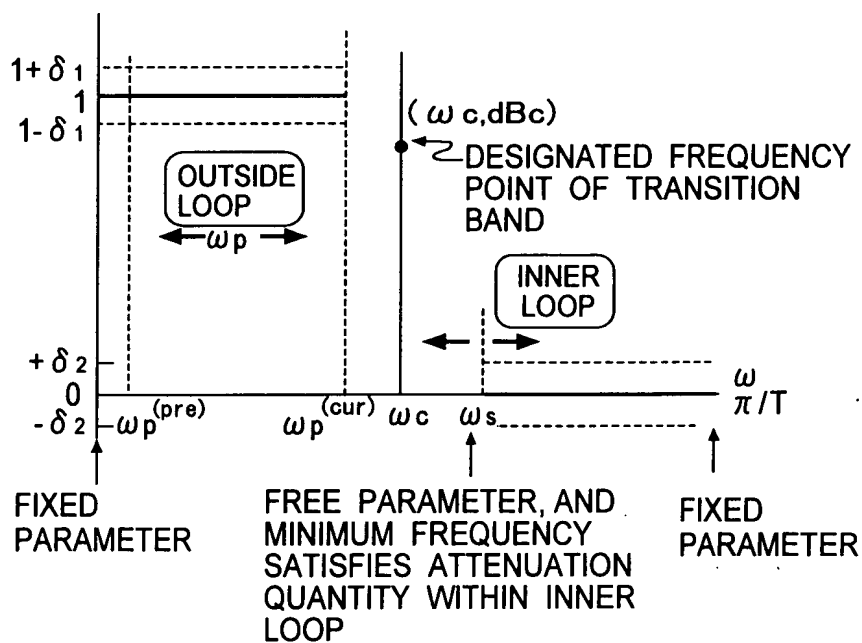
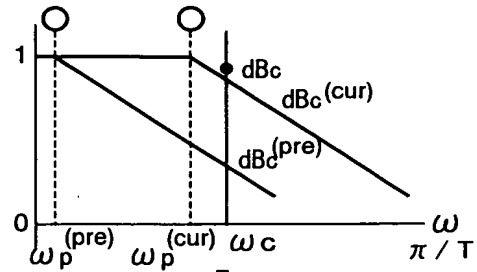


FIG.26



# FIG.27A

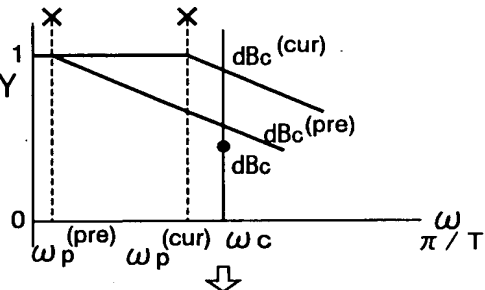
BOTH SATISFY  
→END



FREQUENCY WITH LARGE  $\omega_p$   
IS SOLUTION IN THIS CASE  
SOLUTION IS  $\omega_p^{(cur)}$

# FIG.27B

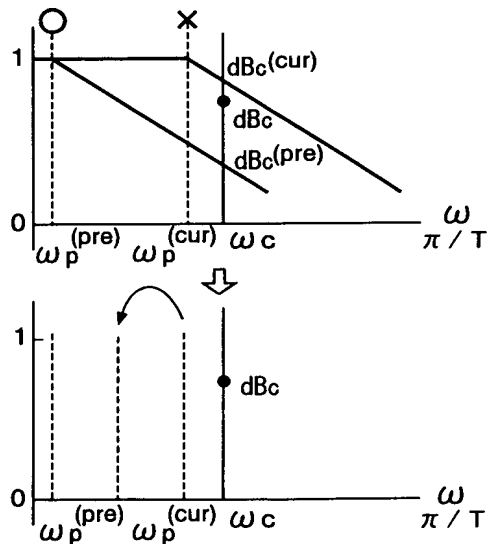
BOTH DOES NOT SATISFY  
→NO SOLUTION→END

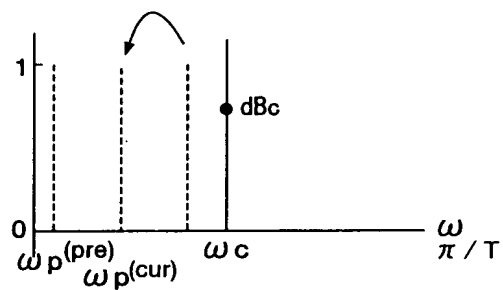
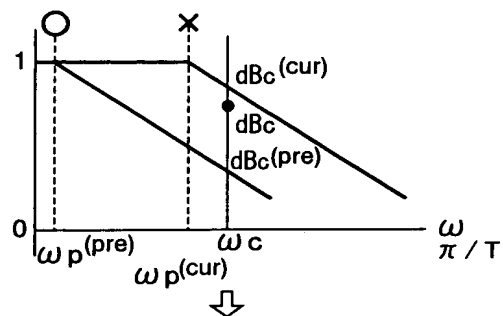


NO SOLUTION IN THE NUMBER OF TAP  
IN THAT IT IS NOT PASSED THROUGH  
POINT  $(\omega_c, dBc)$   
OF TRANSITION BAND

# FIG.27C

ONLY ONE SIDE  
SATISFIES  
→FOR NEXT STEP



[illegible]

**FIG. 28B**  
BOTH SATISFY→FOR  
NEXT STEP

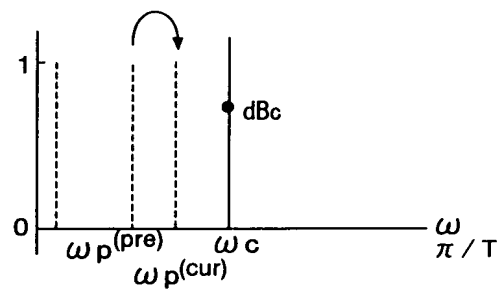
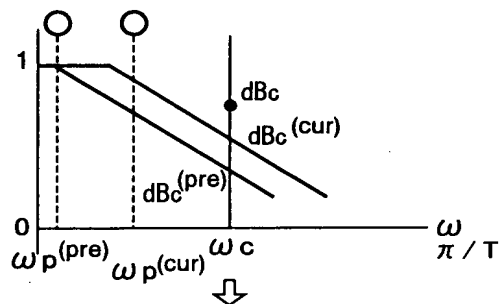


FIG.29

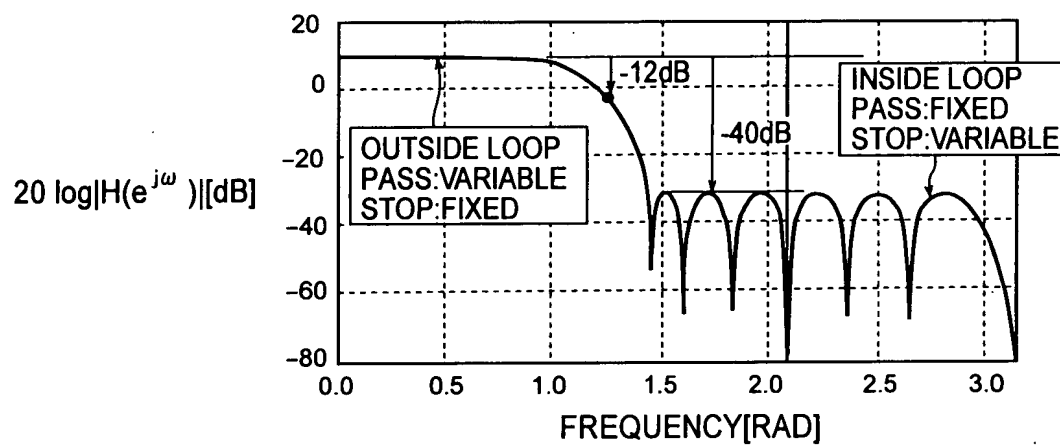




FIG.30

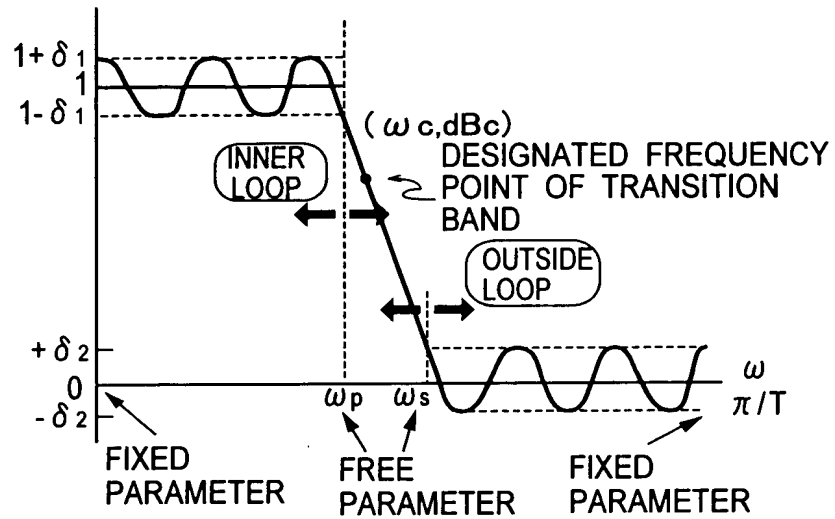
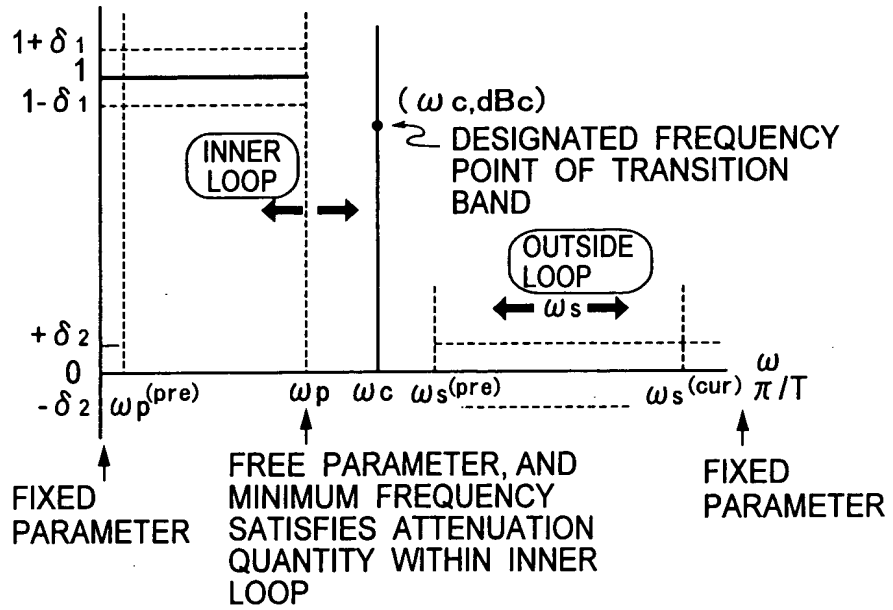
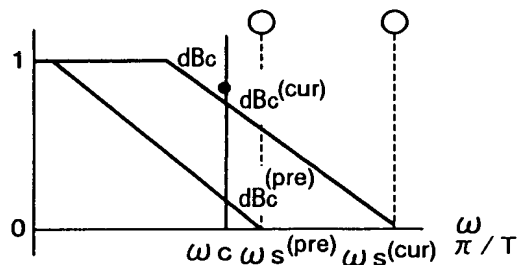


FIG.31



# FIG.32A

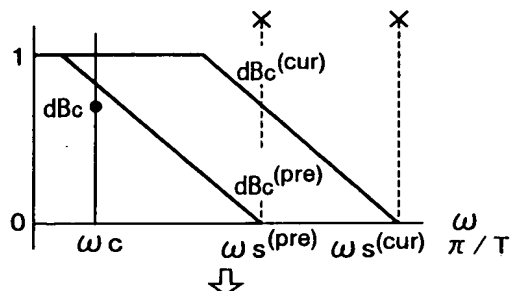
BOTH SATISFY  
→END



FREQUENCY WITH LARGE  $\omega_s$   
IS SOLUTION IN THIS CASE  
SOLUTION IS  $\omega_s(\text{cur})$

# FIG.32B

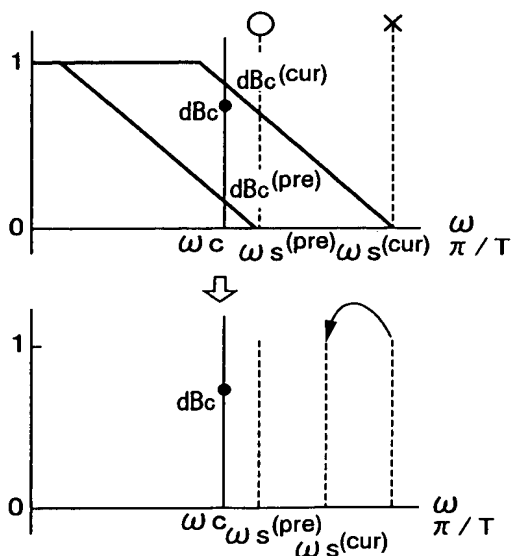
BOTH DOES NOT SATISFY  
→NO SOLUTION→END



NO SOLUTION IN THE NUMBER  
OF TAP IN THAT IT IS NOT  
PASSED THROUGH FREQUENCY  
OF TRANSITION BAND

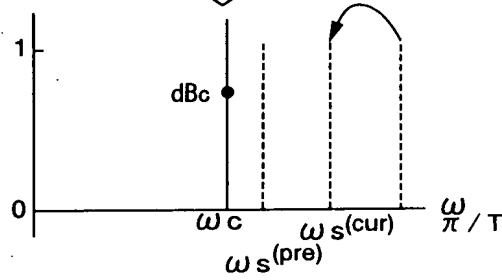
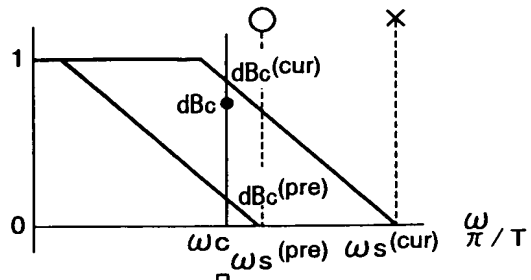
# FIG.32C

ONLY ONE SIDE  
SATISFIES  
→FOR NEXT STEP



**FIG.33A**

# ONLY ONE SIDE SATISFIES



**FIG.33B**

**BOTH SATISFY  
→FOR NEXT STEP**

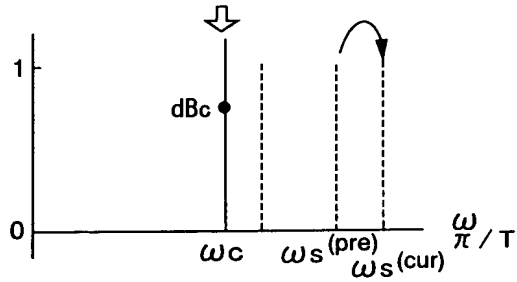
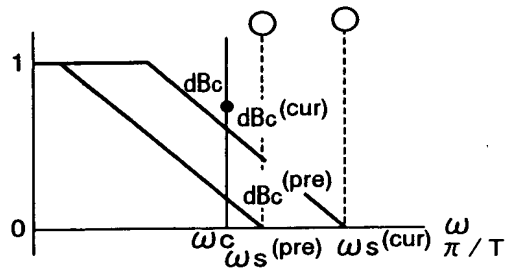


FIG.34

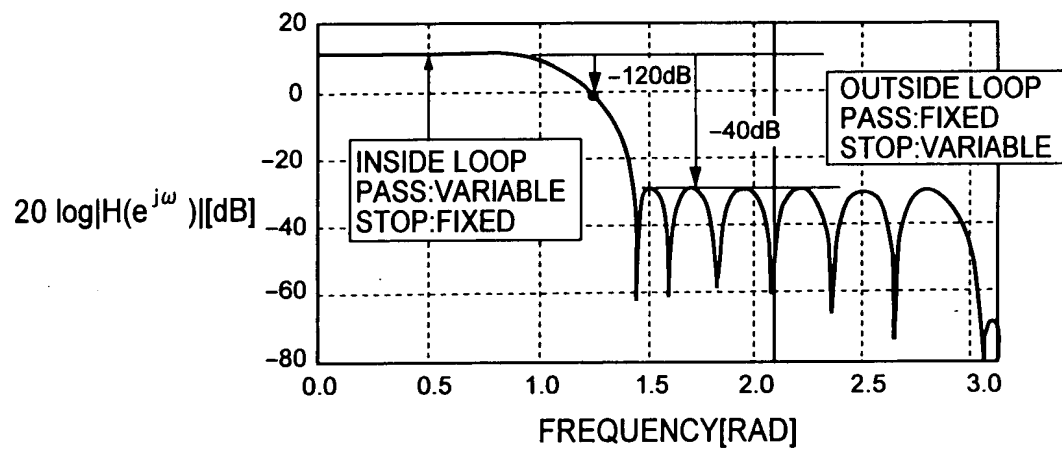
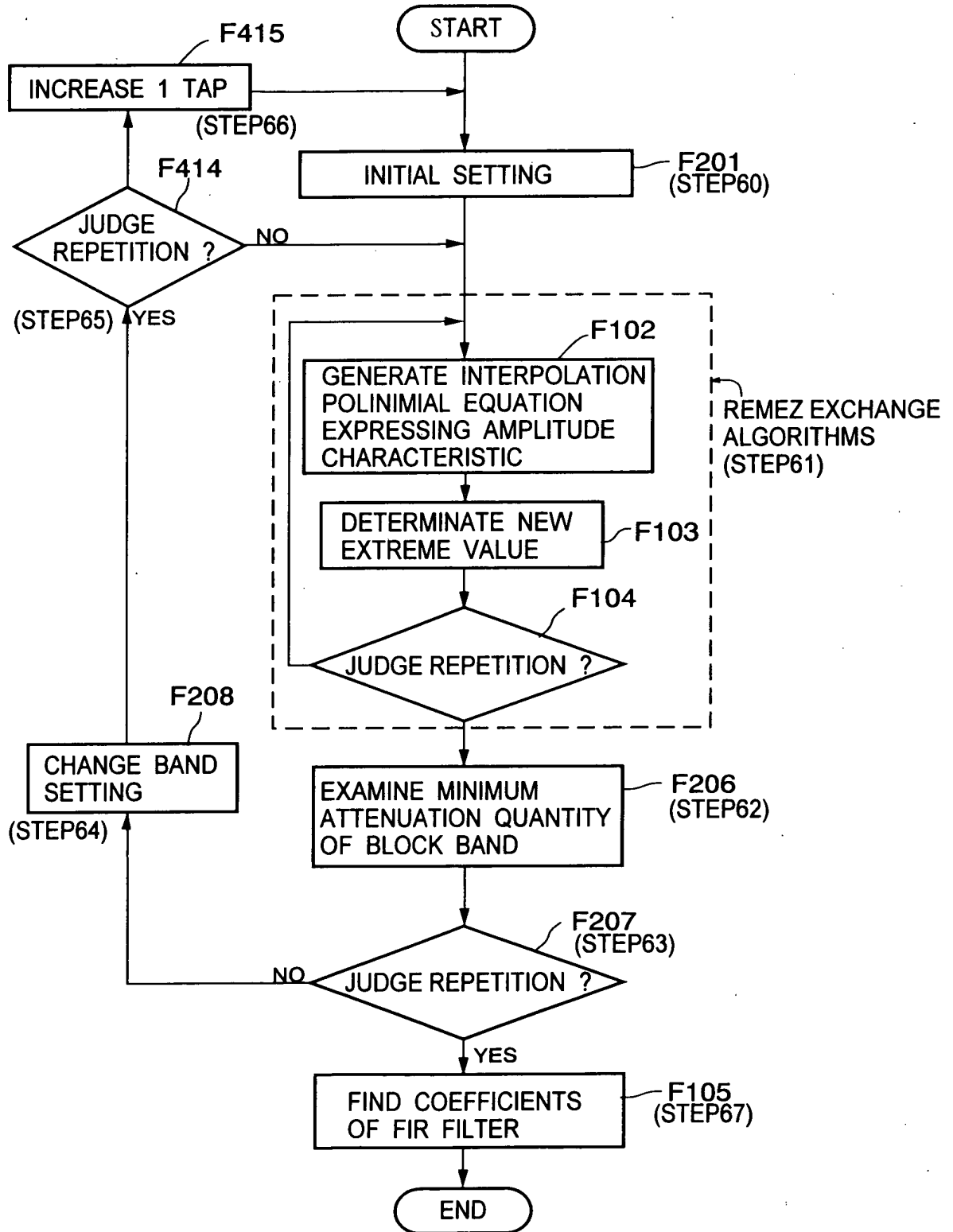
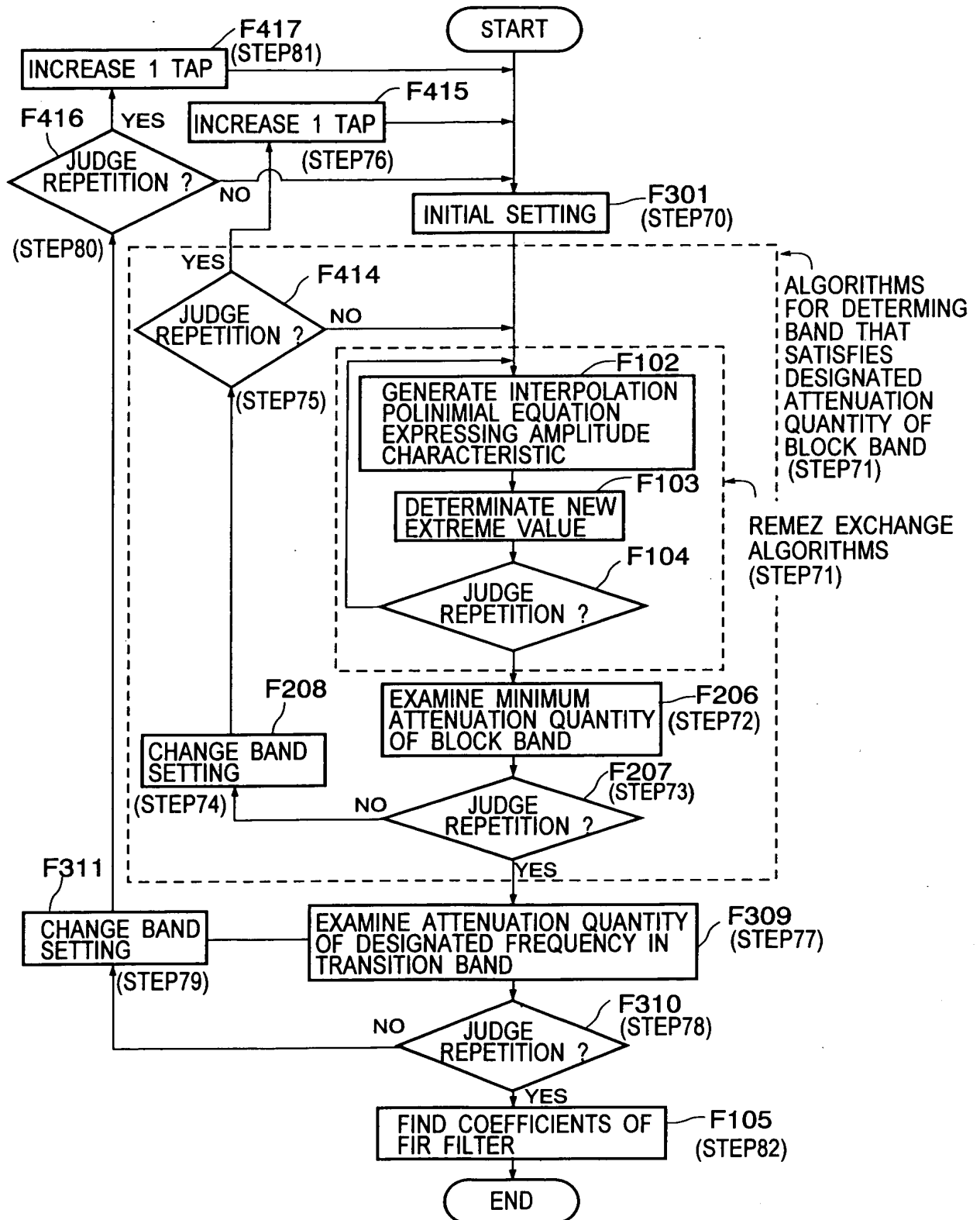


FIG. 35





# FIG.38



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FIG.39

